

# Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I

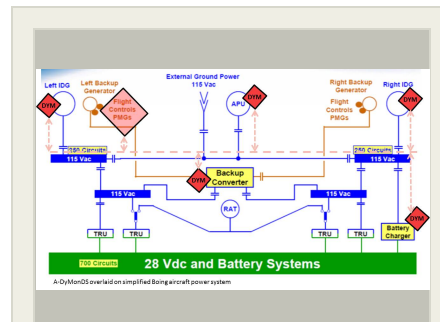
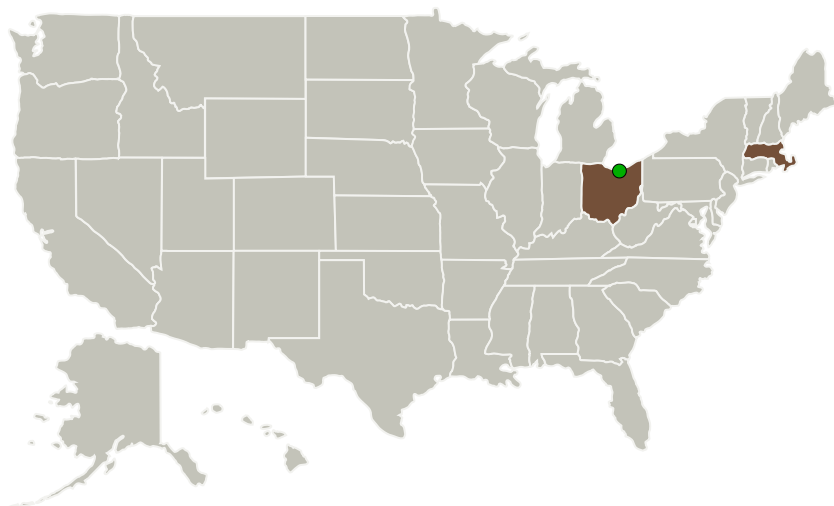
Completed Technology Project (2015 - 2015)



## Project Introduction

We propose to introduce a unifying physics-based framework for modeling, simulating and digitally controlling the aircraft turboelectric distributed propulsion (TeDP) systems. The proposed modeling is sufficiently flexible and capable of zooming in and out to a different level of granularity necessary to capture the relevant dynamics at both component levels and interfaces. Particular emphasis is on ensuring fast transiently stable responses to major changes in aircraft system conditions, both nominal and off-nominal. At present such models do not exist, and are essential for designing control for provable performance. This approach promises to overcome today's disconnect between the aircraft dynamics and electric power system dynamics which we view to be the key roadblock to cleaner and efficient power production, delivery and consumption in future aircraft electric power systems. An Aircraft-Dynamic Monitoring and Decision Systems (A-DyMonDS) framework will be introduced and simulated for several candidate aircraft electric power systems architectures. A higher-level coordinating optimization software will be used to coordinate set points of controllers within the electric power system, and embedded nonlinear digital control for power electronics will be proposed to ensure flexible and reliable power provision over the wide range of aircraft operating conditions, both nominal and off-nominal.

## Primary U.S. Work Locations and Key Partners



Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

# Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I

Completed Technology Project (2015 - 2015)



Organizations Performing Work	Role	Type	Location
New Electricity Transmission Software Solutions(NETSS)	Lead Organization	Industry Women-Owned Small Business (WOSB)	Sudbury, Massachusetts
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

Massachusetts	Ohio
---------------	------

## Project Transitions

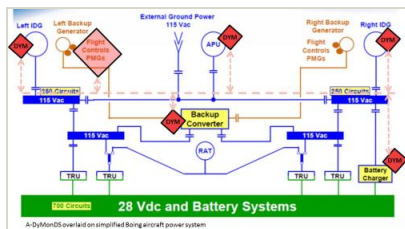
**August 2015:** Project Start**December 2015:** Closed out

**Closeout Summary:** Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I Project Image

### Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/139878>)

## Images



### Briefing Chart Image

Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I

(<https://techport.nasa.gov/image/134360>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

New Electricity Transmission Software Solutions (NETSS)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

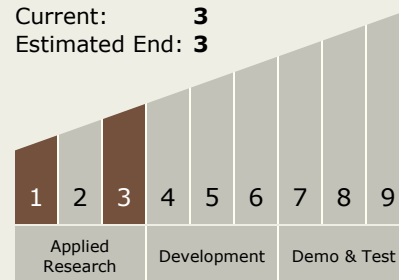
Carlos Torrez

### Co-Investigator:

Sanja Cvijic

## Technology Maturity (TRL)

Start: **1**  
Current: **3**  
Estimated End: **3**



# Toward Autonomous Stable Energy Management of Hybrid Electric Aircraft Propulsion Systems, Phase I

Completed Technology Project (2015 - 2015)



## Technology Areas

### Primary:

- TX01 Propulsion Systems
  - └ TX01.3 Aero Propulsion
    - └ TX01.3.9 Hybrid Electric Systems

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System